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Modification by SiO2 of alumina support for light alkane dehydrogenation catalysts

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Abstract

© 2016 by the authors; licensee MDPI, Basel, Switzerland.Due to the continuously rising demand for C3–C5 olefins it is important to improve the performance of catalysts for dehydrogenation of light alkanes. In this work the effect of modification by SiO2 on the properties of the alumina support and the chromia-alumina catalyst was studied. SiO2 was introduced by impregnation of the support with a silica sol. To characterize the supports and the catalysts the following techniques were used: low-temperature nitrogen adsorption; IR-spectroscopy; magic angle spinning 29Si nuclear magnetic resonance; temperature programmed desorption and reduction; UV-Vis-, Raman-and electron paramagnetic resonance (EPR)-spectroscopy. It was shown that the modifier in amounts of 2.5–7.5 wt % distributed on the support surface in the form of SiOx-islands diminishes the interaction between the alumina support and the chromate ions (precursor of the active component). As a result, polychromates are the compounds predominantly stabilized on the surface of the modified support; under thermal activation of the catalyst and are reduced to the amorphous Cr2O3. This in turn leads to an increase in the activity of the catalyst in the dehydrogenation of isobutane.

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Keywords

Alumina support, Chromia-alumina catalyst, Isobutane dehydrogenation, Silica